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(54) Belt or chain tensioning device with piston having a plurality of reciprocally movable elements

(57) A tensioning device (10) for a belt or chain comprises a cylinder/piston assembly of which a movable element, generally the piston, acts on the belt or chain so as to ensure that it is tensioned and thus ensure taking up of any slack. According to the invention, the piston comprises a plurality of reciprocally sliding piston elements (31, 32) so that a greater useful stroke can be achieved than with conventional devices, having a same size in a retracted condition.

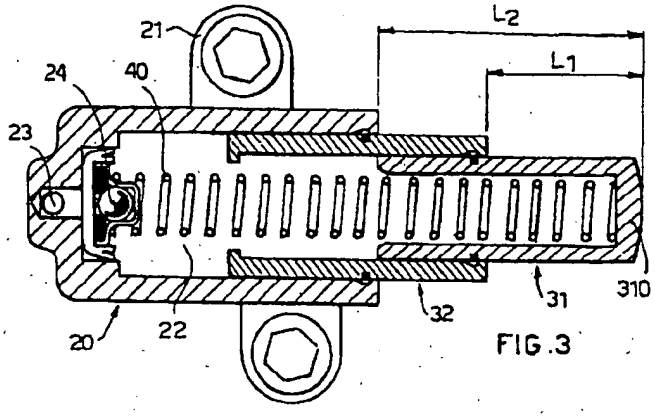

FIG.3

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Description

[0001] The invention refers to devices for tensioning power transmission means such as belts or chains.

[0002] Reference will be made in particular to timing chain means on vehicles, although it is understood that the tensioning devices that will be described can also be applied to other transmission means such as belts, toothed belts and the like.

[0003] A timing system on vehicles, particularly industrial vehicles, generally comprises a chain transmission, in which the chain is wound on two or more sprocket wheels, one of which is a driving wheel.

[0004] Since it is often necessary for reasons of adjustment, wear on materials and take-up of play to compensate for a certain slack on the chain, the use of sliding-shoe tensioning devices, in which a sliding shoe is pushed with an adjustable force against a branch of the chain, is known in the field.

[0005] Various means are known for pushing a tensioning shoe against a chain. The invention refers in particular to cylinder/piston tensioning devices in which a stationary element of a cylinder/piston assembly (generally the cylinder) is mounted on an engine block and a movable element thereof (generally the piston) is sliding with respect to the stationary element and integral with a shoe, which is placed in contact with the chain to tension it.

[0006] United States patent No. 4 826 470 to Breon et al. discloses a cylinder/piston assembly tensioning device, in which the cylinder forms a chamber for pressurized fluid, a static plunger is interposed between the cylinder and the piston, and a spring is interposed between a flange of the static plunger and the piston. The usable stroke of the piston is limited to the extension of the piston skirt, which must never completely leave the cylinder. This patent also describes a solution with a piston formed by two parts that create between them a path for the fluid to exit. The maximum useful stroke of the piston is nevertheless limited by the axial length of the skirt integral with the piston head. The problem of having a greater useful stroke has not even been posed.

[0007] United States patent 4 963 121 to Himura et al. also discloses a tensioning device for a belt or chain drive mechanism that comprises a hollow piston element slidable inside a stationary cylinder; a fluid chamber is defined between two reciprocally sliding tubular elements of which one is fixed to the cylinder and the other moves under the action of a fluid and of a spring, integrally with the piston. In this case also, the maximum useful outward stroke of the piston is defined by the length of the skirt integral with the piston head, and the problem of having a longer stroke is not even posed.

[0008] The invention forming the subject matter of the present application aims to solve the problem of obtaining a longer maximum useful stroke, though having a limited cylinder-piston assembly length in the retracted state.

[0009] The invention relates to a tensioning device as stated in claim 1.

[0010] Further new and useful characteristics are stated in the dependent claims.

[0011] In other words, the new tensioning device comprises a cylinder, a piston movable with respect to the cylinder, the piston comprising two or more reciprocally sliding elements, of which a distal element comprises a piston head and a skirt, and a proximal element, or plurality of proximal elements, comprise a skirt; spring means and a pressurized fluid act in opposition between the cylinder and the distal element of said piston.

[0012] Facing walls of the skirts of the piston elements and the cylinder have reciprocal engaging means to limit the movement of each with respect to the other.

[0013] The new tensioning device allows the piston to be extracted from the cylinder for a much longer stroke than previous tensioning devices, the axial measurement of the tensioning device or axial length of the tensioning device at rest being equal.

[0014] An exemplary embodiment of the invention will be described below with reference to the attached figures, in which it is illustrated only as an unrestrictive example, and in which:

Figure 1 is an axial sectional view of a cylinder-piston assembly of a tensioning device according to the invention, in a retracted state;

Figure 2 is a sectional view similar to Figure 1 but the tensioning device is illustrated in a partially extended state;

Figure 3 is a sectional view similar to the previous figures, with the tensioning device in the position of maximum extension;

Figures 4 and 5 illustrate a tensioning device positioned on a chain drive of a timing system.

[0015] A tensioning device illustrated in the figures is indicated as a whole by reference numeral 10.

[0016] The tensioning device 10 comprises a body or cylinder 20 and a piston or plunger 30 having a plurality of elements. In the particular case the piston comprises two elements 31 and 32, respectively. The body or cylinder 20 has fixing tabs 21 and forms an internal cylindrical chamber 22. The chamber 22 communicates with a supply of pressurized fluid, generally oil, through an opening 23, and a check valve 24, in a per se known manner which is therefore not described.

[0017] The piston 30 comprises a first element or distal element 31 and a second element or proximal element 32. The first element comprises a crown or piston head, 310, and a cylindrical skirt 311. The second, proximal element 32 comprises a cylindrical skirt 321.

Between the bottom of the cylindrical chamber 22 of the cylinder and the head 310 of the distal element a pressure spring 40 is interposed. The outer wall of the skin 311 of the distal element of the piston has a seat 312 for a piston ring 313, in a more or less intermediate position along the length of the skirt 311. The inner surface of the piston element 32 has a groove 322 in the proximity of the distal end thereof, such as to allow widening of the piston ring 313. Engagement of the piston ring 313 in the groove 322 prevents extraction of the distal element 31 of the piston with respect to the proximal element 32 of the piston.

[0018] The outer wall of the proximal element 32 of the piston has a seat 323 for a piston ring 324 and correspondingly in the proximity of the end the inner face of the cylinder 20 has a groove 202 able to receive the elastic ring 324 to stop extraction of the element 32 of the piston from the cylinder.

[0019] The annular grooves or housings 322, 202 preferably have the respective distal wall forming a steep step outwards (that is, toward the right in Fig. 1) and the proximal wall gently sloping inward, that is, toward the left in Fig. 1. The proximal element 32 of the piston 30 has a step 325 in its proximal part facing toward the axis to form an abutment for distal element 31 in a the retracted position.

[0020] Operation of the tensioning device will be described below.

[0021] In the retracted or resting position illustrated in Figure 1, the two elements 31 and 32 of the piston 30 are in the retracted state, that is to say the element 31 is completely or almost completely received inside the cylinder 20. This position can coincide with the initially set position of the tensioning device. The head 310 of the device is suitable to be brought into contact with a shoe, generally an oscillating shoe (Fig. 4) or a translating shoe (Fig. 5) which can be pushed against chain C or the like to tension it. When fluid is introduced through the opening 23 and the check valve 24 into the chamber 22, through the action of the fluid and the spring 40 the bottom of the chamber 22 of the cylinder and the head 310 of the distal element 31 of the piston are drawn apart. This causes the element 31 to be extracted (towards the right in Fig. 1) with respect to the second element 32, and the element 32 to be extracted with respect to the cylinder 20. The position of the elements 31 and 32 with respect to each other and with respect to the cylinder 20 is determined by the balance of forces due to the pressure of the fluid and to the spring, on one hand, and to the reaction of the chain on the other: And, in any case it is limited by engagement of the piston ring 312 in the groove 322, and by engagement of the piston ring 323 in the groove 202. The maximum extension position is illustrated in Figure 3. As can be seen from the figures, for tensioning devices having a same axial length L, (Fig. 1), in the retracted position, a conventional tensioning device could give a maximum useful stroke L1 as shown in Figure 2, whilst the new tensioning device permits a useful stroke L2, marked in Figure 3, which is considerably greater than L1.

Claims

1. A tensioning device for transmission systems with an elongated flexible element such as chains or belts, comprising a cylinder/piston assembly that comprises a cylinder (20) with an inner chamber (22) and a piston sliding between a retracted position and a position extending from the cylinder, a piston head operating on a movable shoe to tension the chain or belt, further comprising supply means (23, 24) for supplying pressurized fluid to said chamber of the cylinder and elastic pushing means (40) between said cylinder and said piston, characterized in that

   said piston (30) comprises at least two piston elements (31, 32) which are reciprocally sliding and sliding with respect to the cylinder, and that said elastic means act between said cylinder and a distal element (31) of said piston elements.

2. A device according to claim 1, characterized in that said piston comprises two said piston elements, that is said distal element (31) provided with a piston head (310) and a proximal element (32), said distal and proximal elements being telescopically slidable with respect to one other.

3. A device according to claim 1, characterized in that said piston elements are cylindrical in shape and comprise limiting means for limiting the extension of one element with respect to the other element and of at least one of the elements with respect to the cylinder.

4. A device according to claim 2, characterized in that each said piston element (31, 32) comprises a spring ring (313, 324) on an outer surface of a respective skirt part and in that grooves (322, 202) are provided on the facing inner surfaces of the other piston element and of the cylinder.

5. A device according to claim 4, characterized in that each said groove has a steep distal circumferential wall and a gently sloping proximal circumferential wall.

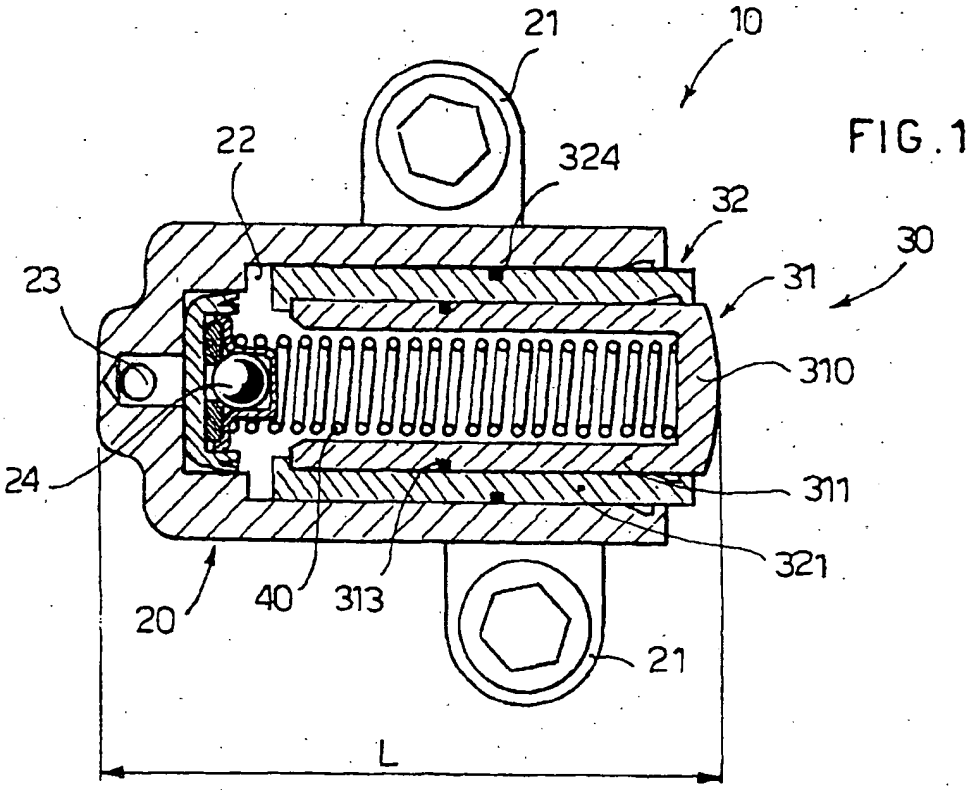
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FIG.1

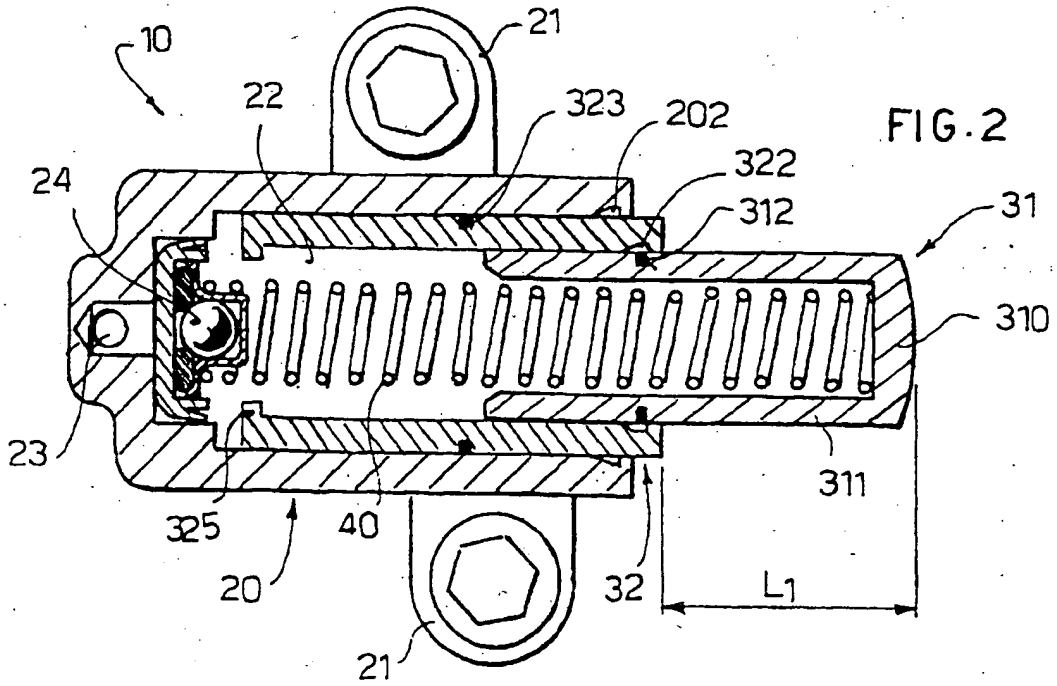
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FIG.2

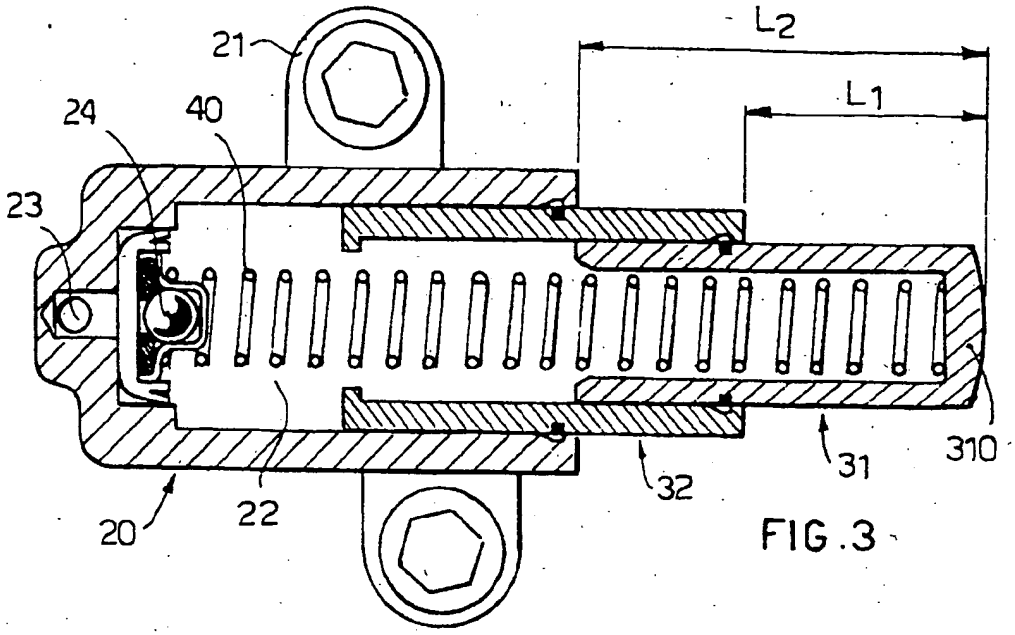

FIG.3

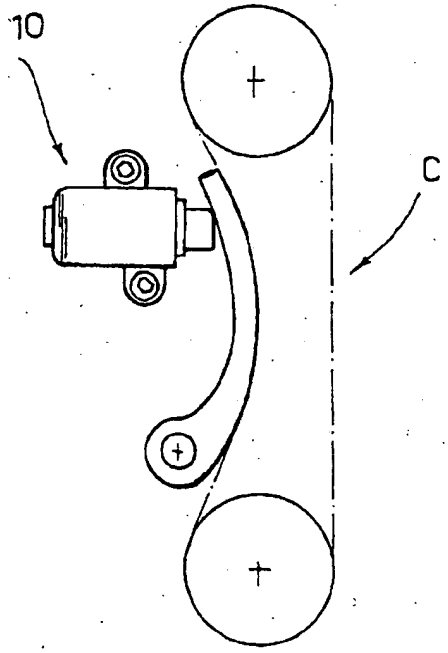

FIG.4

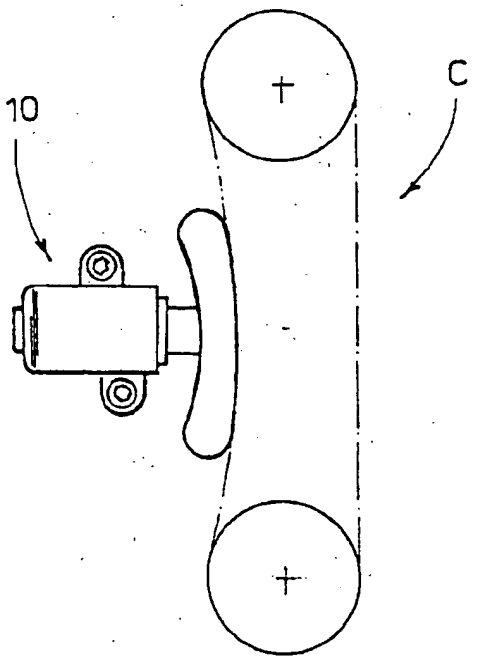

FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0527

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB 2 093 150 A (MASCHINENFABRIK KLAUS-GERD HOES) 25 August 1982 * page 2 - page 3; figure 1 *	1-3	F16H7/08
A	US 5 720 683 A (BORG-WARNER) 24 February 1998 * column 5, line 26 - column 6, line 11; figures 6-9 *	1,2	
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A	FR 2 320 470 A (ALFA ROMEO) 4 March 1977 * page 7, line 19 - page 8, line 12; figure 4 *	1-3	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 February 1999	Flores, E

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